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NOTES FROM PACIFIC COAST OBSERVATORIES¹

NOTES ON THE BINARY STAR SIRIUS

Many interesting and useful speculations rest vitally upon the assumption that two stars of the same spectral type are equally efficient as radiators of light. This is equivalent to saying that two stars of the same spectral type have absolute brightnesses proportional to their surface areas. There is apparently much justification for the use of this principle in discussing the attributes of stars, for stellar spectra are undoubtedly surface phenomena, and spectral types are probably quite definite functions of effective surface temperatures.

This assumption is chiefly responsible for the conclusion reached by one astronomer, that the diameter of a Cepheid variable star of seven-day period may be estimated at twenty-six times the Sun's diameter. A further direct result is that such a Cepheid is 2.7 times as massive as the Sun, but only 1/7000th part as dense as the Sun. From this assumption and its conclusions come seemingly fatal difficulties for the binary hypothesis of Cepheid variables. I am not here defending this hypothesis, but it is undoubtedly of some interest to apply the assumption to the binary star *Sirius*, concerning which we know many facts.

The primary component of *Sirius* is about ten magnitudes brighter than the secondary component; that is, it radiates 10,000 times as much light. Adams, with the 60-inch reflector of the Mount Wilson Observatory, has observed that the spectra of the two components are identical in character, save that the continuous spectrum of the companion seems to decrease a little more rapidly than that of the principal component, as one proceeds toward the ultra-violet. Van Maanen, photographing *Sirius* thru color screens with the same telescope, has given general confirmation to Adams's result, by showing that the two components of the binary have essentially the same color index. Adopting the assumption of direct relationship between spectral class and radiating efficiency, we have the surface area of the principal component 10,000 times as great as that of the secondary. The radii of the two stars are therefore as 100 to 1, and the volumes are as 1,000,000 to 1. Now it is well established that the mass of the fainter component is essentially equal to that of our Sun, whereas the mass of the principal

¹See also Titles and Abstracts of Papers for the Seattle Meeting of the Society, June 17-19, on page 189

component is twice that of the Sun. It therefore follows that the secondary star is 500,000 times as dense as the primary. This is a most surprising result. Are we justified in assigning to it even a fair degree of probability?

As to luminosity and diameter, the principal star is a giant and the secondary star is at least relatively a dwarf; but as to mass they are average stars. Have we any reason to doubt that in years the two stars composing the system of *Sirius* are identically of the same age? Their spectra are of Class A. What has been their evolutionary history to date? Did they begin their stellar lives as Class B stars, and have they traveled along parallel courses of development to Class A stars? Following another hypothesis, did they begin their stellar lives as Class M stars? Have their evolutionary processes travelled along parallel lines and with equal speeds to the Class A stage, where we now find them, or has the giant primary star traveled in one direction from Class M to Class A, whereas the dwarf companion has traveled from Class M in one direction to Class B, and thence in the reverse direction to Class A? If we grant that the primary star is only 1/500,000 as dense as the secondary, which the assumption outlined at the beginning of this note absolutely requires, either one of the evolutionary progressions which begins with Class M involves an extreme of improbability.

Is the assumption of direct relationship between spectral type and radiating efficiency a reliable one? The purpose of this note is merely to raise the question. _____ W. W. CAMPBELL.

NOTE ON THE H α LINE IN THE SPECTRUM OF T PYXIDIS

Photographs with the 10-inch Cooke telescope and a 15° objective prism made on April 21, 22, 23, 24, 25 and 26, 1920, have shown a very strong bright H α line in the spectrum of T *Pyxidis*. The line stands out strongly by itself, being so bright that intense images were obtained in thirty minutes' exposure time. In spite of the low dispersion (approximately 440 angstroms per millimeter at H α) the continuous spectrum in the red is very weak. Seed 23 plates stained with pinacyanol were used.

In the ultra-violet the dark components of the hydrogen lines are much stronger relative to the bright components than at H β and H γ .

May 6, 1920.

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